Chapter 5

Communications

The Paladin's ability to provide highly responsive fires and effects is dependent on reliable, flexible, secure, responsive, and long-range communications. The introduction of radios on-board the howitzer and FAASV offers tremendous flexibility over wire-based gunlines.

BATTALION COMMUNICATIONS

5-1. The communications systems and procedures at the M109A6 battalion level do not differ significantly from those in other M109A5 battalions. FM 6-20-1 outlines communications procedures and nets any cannon battalion uses as it executes its mission of providing fire support to the maneuver force. In a Paladin battalion however, greater emphasis is placed on the use of radio systems at the battery level and below.

BATTERY COMMUNICATIONS

5-2. The increased number of radios, along with a reduction in personnel and equipment available to install and service wire, requires changes in the traditional way the communications section, as well as the battery as a whole, approaches its mission. The dispersion of communications assets within the unit increases the need for mobility and map reading skills among the members of the communications section. If wire is used, especially if the battery wishes or is directed to enter the mobile subscriber equipment (MSE) system, the BC must plan and coordinate with the battalion signal officer for whatever external support is required. If a unit's modified table of organization and equipment does not provide for a 31U (radio repairer), the battalion SOP must address the shortage and provide a solution.

RADIO NETS

5-3. The firing battery normally operates on three secure external radio nets:

- Battalion command net (very high frequency (VHF)-frequency modulated (FM)-voice (V)).
- One of three battalion fire direction (FD) nets (VHF-FM-digital (D)).
- Battalion A/L net (VHF-FM-V).

5-4. The battery also operates five secure internal radio nets:

- Battery command (VHF-FM-V).
- Platoon command (VHF-FM-V) X 2.
- Platoon FD (VHF-FM-D) X 2. Each platoon operates on its own assigned FD net to facilitate automated C2.

Battery Command Net (VHF-FM-V)

5-5. This net enables battery personnel to pass operational and admin/log traffic. The battery commander may designate full time subscribers for this net.

Platoon Command Net (VHF-FM-V)

5-6. This net enables platoon personnel to pass operational and admin/log traffic. Only mission essential traffic should be passed on this net. The POC operates as the net control station (NCS). Failure to practice net discipline diminishes the effectiveness of the battery's command and control.

Platoon Fire Direction Net (VHF-FM-D)

5-7. This net enables each POC (BCS) to communicate digitally with its howitzers. As a matter of SOP, the net frequency and BCS address of the alternate POC should be provided to each COS with instructions to establish digital communications with his alternate POC if his primary POC becomes inoperative or mutual support is required. The operational POC acts as the NCS in this situation. Howitzer section chiefs must avoid masking their radio communications with terrain features or man-made objects as they select firing positions or make survivability moves.

RADIO NET STRUCTURE

5-8. Figure 5-1 illustrates the radio net structure and SINCGARS equipment for a firing battery in a Paladin battalion. Table 5-1 provides an example Paladin firing battery combat net radio matrix.

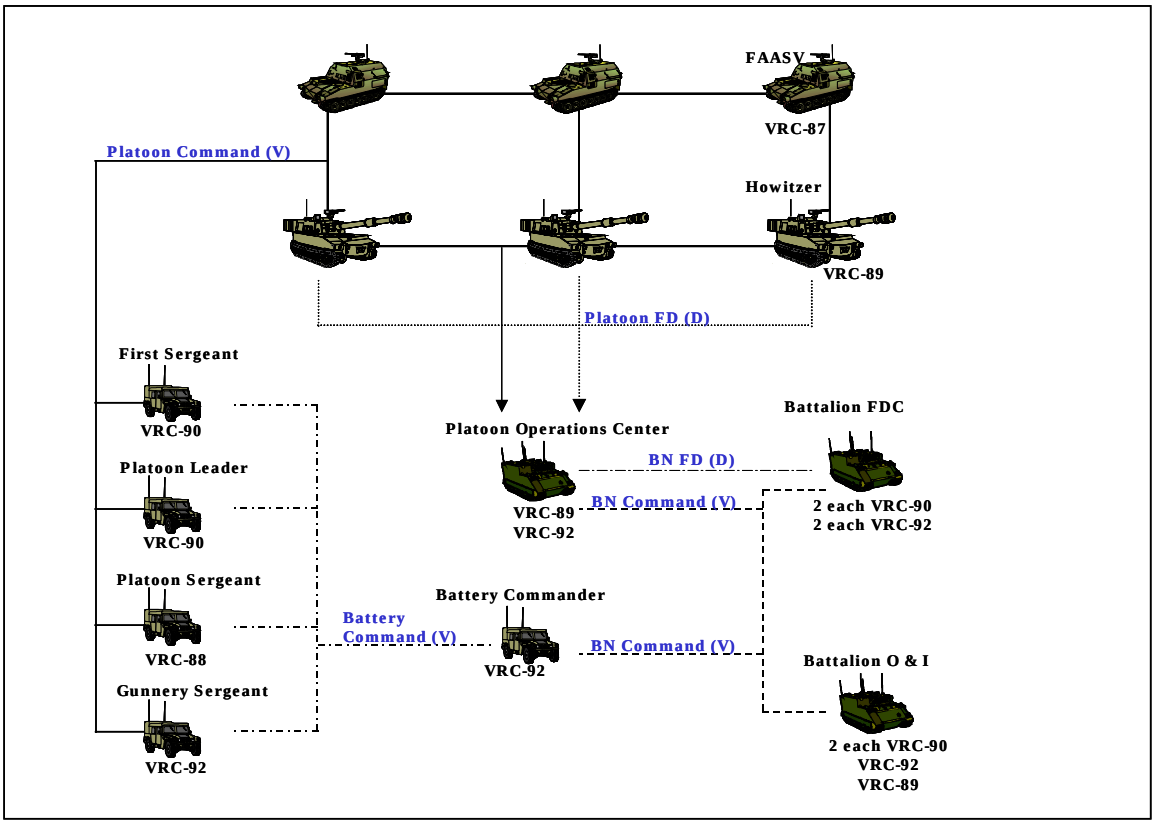

Figure 5-1. Paladin Battery Combat Net Radio (CNR) Structure

Table 5-1. Example Paladin Battery CNR Matrix

FIRING BATTERY CNR MATRIX	BC	1SG	PLT LDR	PLT SGT	POC	HOW	FAASV	GSG
EXTERNAL NETS:								
BN COMMAND (V)	X	A	A	A	A			A
COMMAND FIRE (V)					X			
BN FD 1/2/3 (D)					X			
BN A/L (V)	A	A	A	A	A			
FORCE FA SURVEY (V)	A		A	A				A
INTERNAL NETS:								
BATTERY COMMAND (V)	A	A	A	A	A			A
PLATOON FD (D)					X	X		
PLATOON COMMAND (V)	A	A	X	X	X	X	X	X
LEGEND: X = FULL TIME SUBSCRIBER D = DIGITAL V = VOICE A = AS REQUIRED								

PLANNING CONSIDERATIONS

SETTINGS AND RANGES

5-9. Power output and planning ranges for SINCGARS are shown in Table 5-2.

Table 5-2. SINCGARS Power Output and Range

Power Output	Range
Low	300 meters
Medium	.3 to 4 km
High - Manpack	8 km (voice) 4 km (digital)
High - Vehicular	8 km (voice) 8 km (digital)
Power Amplifier	35 km (voice) 20 km (digital)

MINIMUM COMMUNICATION POWER LEVELS

5-10. The electronic warfare (EW) threat must always be taken into account. Each element of the battery must operate on the minimum power needed to communicate effectively

COMMUNICATIONS PARAMETERS

5-11. Before communicating digitally, personnel must make various software settings in the AFCS and LCU. Many of these settings should be part of the unit TSOP.

NET ACCESS DELAY TIME

5-12. The values set for this function allows each howitzer access to the battery internal FD net. When the LCU transmits data to all howitzers, it is a single broadcast message. If the net access delay time were the same for all howitzers, each would be competing for the same space in time to return an acknowledgment to the LCU. If this were to happen, no AFCS would be able to access the net. By staggering the time for net access, each AFCS has its own space in time to respond to LCU messages.

Communications Sequencing

5-16. Table 5-3 provides an example of communications sequencing used to manage the platoon FD digital net (referred to as net access delay time) in order to maintain communications between the POC and the howitzers' AFCS.

Table 5-3. Net Access Delay Times (POC Only)

Howitzer Logical Number (1st Platoon)	1/1	2/1	3/1
Net Access Delay Time	1.0	1.5	2.0
Howitzer Logical Number (2nd Platoon)	1/2	2/2	3/2
Net Access Delay Time	1.0	1.5	2.0
Note: The net access delay is the same for each platoon as long as each POC is controlling their own guns. If one POC is controlling all six howitzers, then the delay times for those additional howitzers would be as follows: 2.5, 3.0, 3.5 (these are also used as the backup access delay times if POC changeovers occur). In the event the battery acquires additional howitzers, then delay times would need to be modified accordingly.			
1st & 2nd Platoon BCS Net Access Delay	.5		
Note: The BCS has a smaller net access delay time and therefore has the highest priority on the net.			

GUN KEY TIME

5-13. Gun key time is a software setting in the AFCS which allows the radio to key up to full power before digital traffic is transmitted.

BROADCAST ADDRESS

5-14. The LCU can transmit to all howitzers with a single transmission. Each howitzer must have the same address as found in the SYS;SBT. This address is valid only for the LCU**.** Any attempt to use it otherwise causes an error at the LCU, or the AFCS responds with an unable to execute (UTE) message.

PHYSICAL ADDRESS

5-15. This address is used when linking a single howitzer with a TA asset capable of digital communications (i.e., HTU, FED, OH-58D, or radar). This address must be different for each howitzer if more than one howitzer is going to be linked. (Note: AFCS will not allow duplication of the physical address.)

COMMUNICATIONS PARAMETERS CARD

5-17. Shown below (Figures 5-2 and 5-3) are examples of the communications parameter card used to establish both voice and digital communications between the POC and the howitzers during initialization, as well as provide them with backup information in the event that the primary BCS becomes inoperable. This information is included in the unit SOPs and is given to the howitzers prior to starting operations.

NET ACCESS		NET ADDRESS	
NET TYPE:	14	GUN PLTN/SECT:	2/3
NET ACCESS DELAY TIME (SEC):	1.0	BROADCAST ADRS:	B
GUN KEY TIME (SEC):	1.4	PHYSICAL ADRS:	Z
BLOCK MODE SELECTION:	SINGLE	PRIMARY BCS ADRS:	A
NET BUSY SENSE OVERRIDE:	OFF	BACKUP BCS ADRS	C
*NETWORK PROTOCOL:	AFCS	AFCS URN:	16245010
*BAUD RATE:	1200	PRIMARY BCS URN:	12345678
*MODULATION:	1200-2400	BACKUP BCS URN:	143
*WIRE-RADIO LINK:	RADIO	CONTROLLING BCS:	PRIMARY
HOWITZER CALL SIGN:	PAPA 10	DIGITAL NET:	_____
POC CALL SIGN:	PAPA 13	VOICE NET:	_____
BACKUP POC CALL SIGN:	PAPA 20	BACKUP DIGITAL NET:	_____
BACKUP NET ACCESS DELAY TIME (SEC):	3.5	BACKUP VOICE NET:	_____
		DATUM:	
LEGEND: SEC = SECOND PLTN = PLATOON SECT = SECTION ADRS = ADDRESS URN = UNIT REFERENCE NUMBER * = OPERATOR PROTECTED FIELD			

Figure 5-2. Example Communications Parameter Card (AFCS Protocol)

NET ACCESS		NET ADDRESS	
NET TYPE:	31	GUN PLTN/SECT:	1/1
		AFCS URN:	12123234
		PRIMARY BCS URN:	8123215
		BACKUP BCS URN:	123
		AFCS IP:	127. 0. 1. 10
NETWORK PROTOCOL:	188-220A	PRIMARY BCS IP:	127. 0. 2. 20
BAUD RATE:	16000	BACKUP BCS IP:	127. 0. 3. 30
MODULATION:	NRZ	CONTROLLING BCS:	PRIMARY
WIRE RADIO LINK:	RADIO		
HOWITZER CALL SIGN:	PAPA 10	DIGITAL NET:	_____
POC CALL SIGN:	PAPA 13	VOICE NET:	_____
BACKUP POC CALL SIGN:	PAPA 20	BACKUP DIGITAL NET:	_____
		BACKUP VOICE NET:	_____
		DATUM:	
LEGEND: SEC = SECOND IP = INTERNET PROTOCOL PLTN = PLATOON SECT = SECTION URN = UNIT REFERENCE NUMBER * = OPERATOR PROTECTED FIELD			

Figure 5-3. Example Communications Parameter Card (188-220A Protocol)

BATTERY WIRE SYSTEM

WIRE COMMUNICATIONS

5-18. Use of wire in a Paladin battery is usually limited to those periods when a howitzer's radio communication is degraded and it must connect with another howitzer, FAASV, or the POC in order to continue operating or when radio listening silence is imposed by the higher headquarters. Connecting by wire to another howitzer or a FAASV allows voice intercom communications (AN/VIS-3). Connecting to the POC provides both voice and digital communications (if two wire lines are laid). Priority in establishing communications is digital followed by voice.

SINGULAR DATA LINK

5-19. Only one method may be used to establish the digital link over land line. For each howitzer, this is done by connecting one end of the DR-8 wire to the howitzer digital binding post and the other end to the POC LCU wire line adapter binding post. The limitations associated with this method are the amount of available wire and the time it takes to install, maintain, and recover the wire line. Wire cannot be hot looped.

ALTERNATIVE COMMUNICATIONS

5-20. If radio listening silence is imposed, an alternate means of communications (such as wire, messenger, or signals) must be used. Given the constraints on wire, personnel, visibility, mission, time, and the requirement to maintain digital communications between the guns and the POC, the procedures below should be considered when developing the unit TSOP:

- If required, move howitzers to within 1/4 mile (or less) of the POC or platoon terminal board (TM-184) and use DR-8 wire lines.
- Establish a battery wirehead as a connection point for the POCs.
- Consider use of wire line adapter (HYX-57/TSEC for wire line security and remoting.
- Mark lines or provide line route maps for wire repair or recovery operations, if they are used.
- Use other available means (messenger, visual signals) to facilitate communication needs.
- Establish communications with adjacent units, left to right or higher to lower, as applicable.